



OAR Perspective: Collaborative Research Supporting Mobile Source Regulatory Decision Making

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research
and
development

Question

How does ORD research support OAR programs and objectives related to mobile source standards and regulations?

Research Goals

- Characterize tailpipe, brake and tire wear emissions for on-road and non-road mobile sources, with an emphasis on regulated gases, PM and air toxics, to support inventory development, model evaluation and improvement, and regulatory decision making.
- Assess spatial and temporal variability in pollutant concentrations of regulated gases, PM and air toxics near major mobile source emission locations such as urban roadways and construction sites.
- Determine the impact of emerging technologies (fuels and engines) on emissions and exposures to primary and secondary pollutants from on-road and non-road sources.

Approach

Conduct research projects with collaboration between OAR and ORD in *all* phases of the project: planning, design, implementation and analysis.

• Kansas City light-duty vehicle emission study

OAR and ORD (in collaboration with state and local agencies, the Department of Energy's National Renewable Energy Lab, the Federal Highway Administration, and the Coordinating Research Council) are leading efforts in determining the distribution of PM emissions from the on-road, light-duty motor vehicle fleet in the U.S. This study is characterizing exhaust emissions from approximately 480 in-use consumer cars in the Kansas City metro area.

- This project is critical to OAR's gasoline PM initiative: an evaluation of the existing levels of PM emissions from gasoline powered vehicles to determine the adequacy of existing emissions models (MOBILE and MOVES) and the potential need for future regulations.*

• Near road exposure studies

The Traffic-Related EXposure (T-REX) studies will evaluate concentration gradients of PM and gaseous constituents related to motor vehicle emissions near major roads in New York City and Detroit to evaluate and improve existing air quality dispersion models and exposure assessment techniques used in epidemiological evaluations, and identify the intrusion of motor vehicle emission constituents into nearby buildings.

- T-REX will provide important data to OAR and other organizations (such as FHWA) for the development and evaluation of tools to conduct project level impact assessments for a number of transportation-related facilities.*

• Small Engine Emissions and Exposure Studies

OAR and ORD jointly funded studies assessing emissions and personal exposures during the operation of small, gasoline-powered lawn and garden equipment, providing the foundation for developing emission inventories for small engines and determining the range of exposures for equipment operators.

- Emissions and exposure data have provided critical information supporting the Small Gasoline Engine Rule.*

• Mercury and trace metal emission study

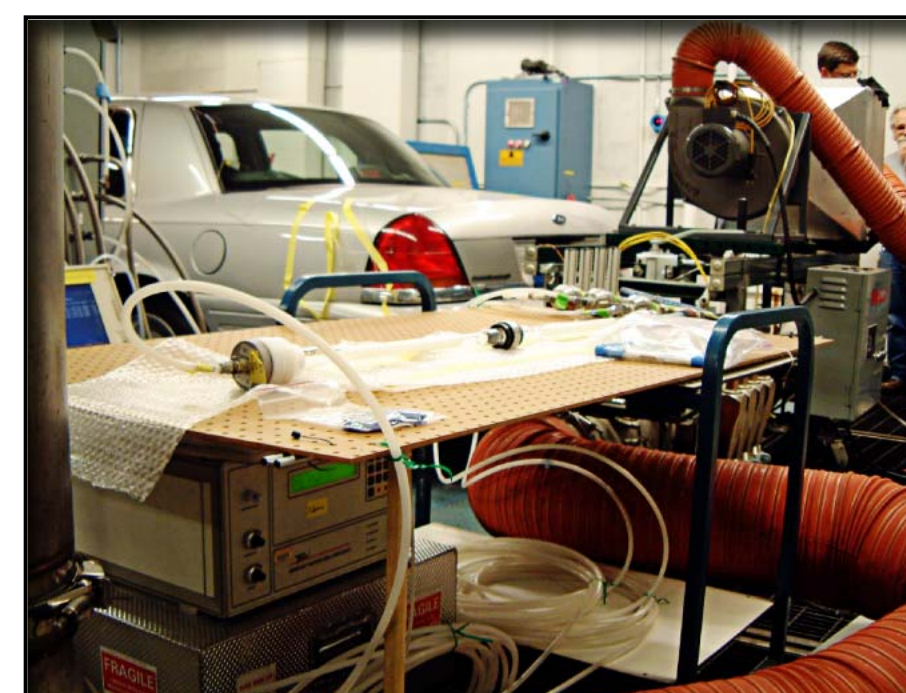
OAR and ORD have begun a project measuring emissions of mercury and other trace metals, which contribute to PM, from light- and heavy-duty on-road vehicles. The project entails the development of methods for mercury measurements, and the identification of sources and rates of heavy metal emissions from both tailpipe and brake wear. This project is being fully funded by OAR, and will enable the calculation of a credible mobile source inventory for mercury, arsenic and other trace metals.

- This information will be useful to OAR in establishing policies and standards for mercury and other trace metals.*



Measuring exhaust of PM and other constituents in the Kansas City light-duty vehicle emission study

Continuous and integrated measurements of elemental, reactive gas, and particulate phase mercury



Assessing the influence of motor vehicle activities on elevated pollutant concentrations near major roadways

Characterizing exhaust emission rates from a string trimmer



Assessing exposures during the operation of a push lawnmower

Results

- Improved emission inventories and models quantifying the distribution of PM emissions from the light-duty motor vehicle fleet, including the fraction of "high emitting vehicles."
 - Reduces uncertainty in SIP development, risk assessments, and regulatory decision making.*
- Characterization of how mobile source activities result in elevated concentrations of pollutants near major roadways.
 - Improves tools for project level impact assessments, residual nonattainment evaluations, exposure assessments, and regulatory benefits assessments.*
- Emission rates from small, gasoline-powered non-road engines for regulated gases, PM and air toxics to quantify the contributions to national emissions, evaluate the effectiveness of existing and determine the need for future controls and standards.
 - Improved exposure estimates for engine operators reduces uncertainty in rulemaking benefits assessments and control technology evaluations.*
- Emission rates for heavy metals (mercury, arsenic, etc.) to determine the contribution of motor vehicles to national emissions.
 - Identify the need for future regulatory action.*

Mobile-source regulations result in significant health improvements

Mobile source emission regulations reduce exposures, leading to improved public health. For example, PM and O₃ reductions from the Nonroad Diesel Engine standards are expected to result in:

- 12,000 fewer cases of PM-related premature mortality,*
- 15,000 fewer cases of nonfatal heart attacks,*
- 200,000 fewer asthma attacks in children,*
- over 5.9 million fewer minor restricted activity days due to respiratory conditions.*
- Total monetized benefits over \$83 billion in 2030.*

Future Directions

ORD and OAR will continue collaborations to:

- Characterize modal emissions** from motor vehicles under varying operating and environmental conditions for existing and new technology vehicles.
- Continue assessment and development of **emissions and air quality models** predicting traffic and environmental condition effects on pollutant concentrations near major roads or non-road engine activity.
- Support **near-road epidemiological investigations.**
- Identify **secondary chemical reactions** during transport and dispersion of mobile source emissions.
- Assess the **significance of attached garages** to indoor concentrations and personal exposures to mobile source emissions.
- Eventually enable EPA to **measure health outcomes** not currently captured in our benefits assessments, such as near-roadway impacts not captured in traditional regional air quality models.

Impact and Outcomes

- Support mobile source regulatory development for on-road and non-road vehicles (MSAT2, Gasoline PM, Small Engine Gasoline Rule).*
- Evaluate and improve emission models (MOBILE, MOVES) and national emission inventories.*
- Improve exposure assessment methods used to determine the impact of mobile source emissions on adverse human health outcomes.*
- Evaluate new technologies for regulatory accountability assessments and decision making (Tier 2, HD07, MSAT, Small Engine Gasoline Rule).*
- Increase ability of transportation planners to develop stronger policies and more complete planning assessments using ORD tools.*

Source to Health Outcome